

MOBILE COMPUTING DEVICES

CROSS-REFERENCE TO RELATED APPLICATION

The subject matter of this patent application is related to the subject
5 matter of U.S. Provisional Patent Application No. 60/463,453, filed April 16,
2003, priority to which is claimed under 35 U.S.C. § 119(e) and which is
incorporated herein by reference.

Detailed Description

10 Mobile language translation using statement-speaking devices has been
developed. To achieve widespread application and continued use, it is
advantageous to reduce costs associated with such translation, and devices
providing such translation. Low price points would permit repair and/or
replacement as needed to accommodate field operational use and loss. Current
15 cost factors often relate to durability issues, for example the durability of pocket-
based personal computing devices. Harsh field environments and associated
activities yield multiple failure potentials, including failure of the exposed
screen, water infiltration at points in the casing and/or controls, and mechanical
shock susceptibility. Additionally, non-integrated speaker solutions used for
20 translation often can be problematic.

Translator device efforts, for example military translator device efforts
for achieving battle-ready capability, as well as consumer/commercial translator
system success, require meeting a number of challenges, including lower initial,
replacement and/or repair costs, improved system form factor, enhanced

ruggedization to reduce field down time, extended battery time, higher resolution, lower power graphic display of phrases and translation activities in all light conditions, combined phrase language translation and near-real-time two-way continuous translation, archives of all activities and computer

5 messages, lower optical, electromagnetic and acoustic battle field signatures, improved human engineering for highly intermittent use and one-hand or no-hand operation, improved mounting or support on the body, voice input/output for moderate- to high-noise environments, additional processing power, connected and wireless options to permit multi-purpose use, investment for

10 future and more advanced applications, and capability to run new, more-advanced translator software and use best-possible methods when in the field.

Embodiments of the invention achieve these and/or other advantages.

According to embodiments of the invention, a new product appropriate for both military and commercial off-the-shelf (COTS) markets offers a

15 considerably more durable design than believed previously known.

Embodiments of the invention incorporate the latest available and soon-to-be available COTS components, rather than repackaging previously designed COTS component products and casing. Embodiments of the invention reduce field operational losses and down time, e.g. by improving durability and ease of field

20 repair. Embodiments of the invention also provide much advanced processing, hardware device options and unique qualities for mobile language translation.

Recent changes in high-speed COTS mobile components provide operational advantages, according to embodiments of the invention, e.g. pairing

phrase translation with two-way language translation development, to provide significant opportunities to accomplish broad goals. User validation of product direction, component and application data gathering, technical design detailing, cost estimating, application demonstrations, wireless system design

5 considerations, vibrating speaker integration design and testing, and future custom interface applications are contemplated, according to embodiments of the invention.

Embodiments of the invention use both a “phraselator” and two-way continuous speech language translation. Embodiments of the invention are

10 small, highly mobile and fully OS capable. Case designs provide more easily protected form factors. Tough, impact-resistant casing embodiments are appropriate for soldier, consumer, and other users. Thermally conductive material, e.g. case material, for heat dissipation is contemplated. A new, small-sized standard for high-end processing at low power with large-image display

15 provides additional advantages. Nested configuration, innovative power supply design and coordinated component placement achieve advantages believed not previously known. Next-generation and integrated wireless chips allow a wide range of military, commercial and consumer tasks. Integrated and embedded case-vibrating speaker(s) and/or noise-canceling microphone(s) are

20 advantageous for language translation and/or voice interface applications, according to certain embodiments. Organic light emitting diode (OLED) displays provide about 300mAh capability or better, yield a low-powered display creating its own light source, integrate support for on-chip transistors, provide

very high resolution with wide aspect viewing, and provide very large (e.g. up to about 60+ inch effective diagonal) images.

A personalized display according to embodiments of the invention projects light to the eye, but not to the environment, when in place. An eye

5 sensor and system-on software protect e.g. a military user from projecting his/her location, while saving power and time, and reducing switches. Apparent brightness of the display is unaffected by ambient light, because it is directed to the eye by an enclosure. The total display space requirement with appropriate lensing is also very small.

10 A stack of e.g. of three or another number of the latest lithium-ion batteries or other power supply provides relatively long-term field power. For intermittent use, averaging ten minutes per hour, embodiments of the invention operate for days with a quick-on feature. Through-case charging system capabilities provide other advantages. A case according to an embodiment of the

15 invention is placed into a holder without plugs, and power charge transfer is made through the cased surface, eliminating a connector with its potential failure or leak point. Quick-swap also is made a viable field alternative.

Embodiments of the invention also include a completely sealed, water-resistant package, and/or a waterproof package meeting long-term underwater

20 protection requirements.

Embodiments of the invention also integrate new user interface methods, uniquely qualifying them to meet challenges of two-way translation, voice activation, and quick application changes. A twin-mouse control feature

provides one mouse operating as a normal, traditional mouse, while a second mouse is dedicated to quick scrolling through selected applications or features.

For example, a second mouse optionally is used to intuitively toggle between phraselator statements and continuous two-way translation, or between

5 command, communication, maps and translation verification activities. Voice recognition also can be used for controls.

Small, highly mobile, processor-based COTS products according to embodiments of the invention benefit from e.g. Centrino brand chips or better, e.g. to reduce micron size to about .09, about .06, and/or less than about .04
10 microns, placing the chip well within e.g. an XScale window but with multiples of performance. Consumer, commercial and military buyers have a growing desire for integrated wireless advantages, which the Centrino brand or other brand chip sets provide, according to embodiments of the invention. Advanced branch prediction, dedicated stack manager, power optimized processor system
15 bus, and micro-op fusion, greatly reduce power consumption and heat while improving battery life, according to embodiments of the invention. Increased processing and bus speeds allow successful use of new software applications, including two-way language translation applications. Bus speeds of 32 bits or better are provided, versus e.g. 16 bits with XScale/Pocket PC.

20 Specific embodiments of the invention provide a new COTS device using e.g. a .09-micron Centrino chip set, 802.11 and Bluetooth wireless interfaces, OLED viewer micro-displays, and integrated speaker(s) and noise-canceling

microphone(s), in a tough, sealed case. In-field translation applications, and other applications, benefit tremendously.

Wireless integration is becoming a standard for mobile processing devices. Power savings efforts in this regard provide many advantages for 5 consumer and military markets and allow embodiments of the invention to become a widely adapted single device solution. Multiple body-mounting solutions, for example an armband-mounted device, are viewed and used for communication, while e.g. a soldier uses both hands and arms to point and/or shoot a raised weapon.

10 Embodiments of the invention provide a new enclosure type and system assembly process. Such embodiments incorporate a pre-assembly frame containing major subsystem blocks, inserted into a protective tube case and seal-capped. Embodiments of the invention permit a user or others to quickly and intuitively upgrade or replace one or more of the few hardware components 15 present, at a lower cost than is associated with total system replacement.

According to one such embodiment, a drawer (pre-assembly frame) of quick-swap components is pulled open from a protective tube case. Color-coded blocks making up the system are readily exchanged. Specific-example blocks include, for example, display with optics, battery, computer electronics, wireless 20 with antenna(s), power supply, and memory cards. Software updates are wirelessly downloaded, according to embodiments of the invention. Because of the wireless download capability and surface recharging described elsewhere

herein, the sealed case according to embodiments of the invention remains closed.

Embodiments of the invention also are believed to demonstrate the world's smallest, most-efficient and most-durable full OS personal computing 5 device with integrated wireless capacity. It is fully capable of quickly performing the most advanced two-way language translation applications.

Figure 1 shows end-viewer tube shape options, according to embodiments of the invention. Figure 2 illustrates viewer tube sectional options, according to embodiments of the invention. Figure 3 illustrates side and edge 10 views of square-tube shape options, according to embodiments of the invention, including a neoprene cap with eyepiece, batteries or other power supply, PC/wireless, memory and power supply boards, appropriate lensing, one, two or more mouse devices, an OLED internal display, speaker, heat ribs, and USB and compact flash capabilities, with optional dimensions shown. Of course, multiple 15 materials, components and dimensions are contemplated according to embodiments of the invention. Figure 4 shows processor layout graphics, according to embodiments of the invention.

Embodiments of the invention integrate the following COTS hardware into a robust packaging format: an extruded tube case of aluminum or other 20 material, a Centrino or other brand mobile chip set with related transceiver(s) and antenna(s), lithium-ion or other batteries or power supply, production solid-state nonvolatile cards and slots (e.g. two compact flash, OS and application), and eraser-type mice. Windows XP OS application operation capability is

provided with on/off switching and automatic sleep/on sensor capability e.g. at the eyepiece illustrated in Figure 3. Phraselator operation is activated by one or more mice, with output statements on the vibrating case speaker illustrated in Figure 3. Two-way language translation application using integrated noise

5 canceling and/or Bluetooth noise-canceling microphone(s) also are provided.

Quick and easy user-swappable computer “blocks” or modules reduce repair cost and shorten down-time. Field maintenance repair optionally is accomplished without tools, as will be described. Embodiments of the invention also provide a waterproof case (e.g. capable of surviving 30-minute immersion

10 in 3 feet of salt water), and e.g. three-foot drop-test survival. Full tube-surface heat-dispersal is provided, with one or more processors or processor boards or chips mechanically and thermally positioned “tight” to an inside tube case surface automatically, in a fully assembled mode. The case also optionally functions as speaker and/or as charging contact area.

15 A viewer-end “plug” works as an assembly access and alignment mechanism for computer or component installation into the case. Manual on/off system-switch and automatic user-sensor wake/sleep-switch capability is provided. Total assembly without tools also is contemplated. Longer mission life per size for equivalent operation times and features, using e.g. automatic use-

20 to-sleep and sleep-to-use interface capability, larger battery and more efficient 0.9 micron version processing, also are contemplated. Three-to-four-second-delay two-way continuous speech translation application, or better, is contemplated. Noise-canceling microphone capability is integrated into the eye

shield/lens protection and/or embedded noise-canceling microphone into the viewer end of the device, with e.g. a necklace and/or linear array integrated format for a remote person. Bluetooth wireless capability, using e.g. a 5 Bluetooth-connected noise-canceling microphone, also is provided. Plug-in hardware options, integrated antenna(s) and color SVGA OLED micro-display capability also is contemplated, according to embodiments of the invention.

Embodiments of the invention are generally in the shape of square, e.g. a square of about 3.5 inch by 3.5 inch dimension, with an inch or less of thickness. Of course, other dimensions are contemplated. When e.g. pinched together 10 between the thumb and forefingers and held up to the eye of a user, a micro-display or other display is located at the top of the edge of the device, and a microphone is located at the bottom of the device. Embodiments of the invention are generally no thicker than the width of the micro-display. The average human form factor distance from the center of the eye to the corner of 15 the mouth is about 2.5 or 3.0 inches for an adult, providing a desired general dimension or guideline for the casing of the device, with length being variable and being chosen based on e.g. internal components, capabilities, etc. When gripped in a human hand vertically and viewed on edge, the micro-display is at the top of the edge of the device and one or more microphones, e.g. for noise 20 canceling, are at the bottom. Such placement centers the display with the user's eye, and the microphone at the corner of the mouth, according to average human form factors and best microphone noise-canceling placement methodology. Of

course, other component placement, optionally in combination with longer squared tube shapes or dimensions, are contemplated.

Dual mouse interface capability also is provided, as referenced above.

One mouse is used in standard operating practice for standard mouse operations,

5 and the second mouse is used e.g. as a dedicated scrolling activation device for changing applications or features. The mice optionally have different tactile coverings to assist the user in identifying and distinguishing the two.

Embodiments of the invention contemplate a computing device with two mice, e.g., one standard, and one dedicated to one or more specific activities.

10 Major device components are provided in sections or blocks and placed into one or more drawers, each drawer optionally being in the shape of a frame, or a frame with sections, to hold major components. The sections or blocks optionally are colored for identification, and the respective drawers optionally have matching colors to identify placement location. For example, a white

15 plastic molded frame has a door on one end of a drawer, which has an opening for viewing of the screen. A user or assembler/repairer pulls out the drawer, which for example is a bottomless drawer, and snaps e.g. major components in, for example, a battery, a video component section, a PC section, a wireless and memory storage section, a power supply or other component section. One

20 embodiment of the invention has five such major components, each plugged in and having different colors. Upgrade and repair are readily accomplished, with a drawer simply being opened, the component being repaired or replaced, and the drawer being slid back into the casing or other portion of the device.

The overall device optionally is placed in a tube as a case, for example from one end, with components and drawer(s) being pre-assembled. The tube optionally is capped at one or both ends, to provide water and dust resistance or proofing. One end of the tube optionally has the micro-display and microphone

5 as part of an associated drawer. The dual mouse interface is at e.g. a top edge of the device, at a human-factor accessible location.

On/off and/or sleep or other activate/deactivate conditions are triggered automatically when a user looks into the device and/or holds the device up to the user's face, by way of e.g. a proximity sensor, gravity sensor, motion sensor, or

10 other device. Alternatively, or additionally, one or more mice, or some combination of viewing and mouse/mice, cause activation/deactivation.

The tube-as-case optionally incorporates a speaker having a vibration mechanism, optionally integrates a camera, GPS and/or cell phone, and optionally integrates a battery charger and/or power supply through the surface

15 of the case. The tube optionally is shaped as a square tube, at least at the viewer end. A microphone and flip-down mechanism associated with the microphone, or a microphone that is built into the bottom of the device, aims toward the user's mouth location. A secondary microphone with e.g. linear array technology is built into or along the side of the tube case, e.g. for picking up

20 another person's voice.

According to embodiments of the invention, a PC and/or communication electronics system is housed in a tube-shaped extrusion made of heat-transferring material and plugged or capped at each end. A processing,

computing, and/or wireless communication device resides inside the tube case after being inserted from one or both ends. The inside of the tube case, and/or the inside walls of the tube case, are used to house and protect a viewing lens and micro-display feature as referenced previously. One or more wedges and/or

5 caps plug into the tube in such a way to press against e.g. the processing board or other internal component, to secure and provide contact against the tube such that the tube acts as a heat emission/heat sink and case combination. The inside of the tube case is used to house a battery, optionally removable and chargeable and optionally accessed through the end of the tube away from the viewing end.

10 The battery optionally is charged through the surface of the tube, such that power supply re-charge occurs without breaking the seal of the tube or otherwise compromising the tube, for example by electrical connection provided directly between the power supply and an external conductive portion of the casing or the entire casing itself.

15 The tube optionally is placed into storage and/or docked to other devices and/or a charging device, e.g. using an end of the tube as a primary connection point. The micro-display is directly mounted on the backside of the processor board toward the inside of the device, according to one embodiment, and the viewer design includes a reflective surface to provide an image in a correct orientation to a user of the device. The micro-display also is optionally mounted in a viewing-end plug. A lens associated with the display is held in alignment by the shape of the viewing end plug. One or more mice are notched into an end of the tube by way of a slot, and dual-mouse capability is provided via that slot or

other slots, according to embodiments of the invention. The viewer end plug optionally is designed to provide cushioning around the user's eye and to block light emission and intrusion.

An end opposite to the viewer end houses one or more cameras within 5 the tube, optionally with the camera lens being extendable or retractable within the tube, or optionally within a secondary tube mounted e.g. in a telescoped fashion on the outside of and extending the length of the tube. Viewing and/or camera lens ends are covered for protection during non-use.

Activation of operation occurs with a position or orientation change, as 10 sensed with a gravity-based sensor, for example, to switch between on/off/sleep modes automatically. According to one example, movement to a horizontal position from vertical turns the system on in the sleep mode, and bringing the viewer sensor to the user's eye turns on the device fully from the sleep mode.

Processing boards optionally are placed against the inside of one, two, 15 three or four sides of the device, or with flexible circuit boards in against the inside of a circular tube. One or more processing devices are sealed for protection by filling or covering areas at the end of the tube with plugs or covers. A protective, flexible eyepiece is removable and/or foldable over the tube, e.g. for users with or without eyeglasses. Tube thickness is selected to meet or 20 exceed heat sink requirements. Areas adjacent to one or more processors are customized in shape or thickness to meet or exceed heat sink requirements.

A microphone is integrated into the near-eye tube-end plug, so as to be located adjacent the user's mouth when in use. Optional integration of the

microphone into a viewing lens cover, such that uncovering the lens or viewer simultaneously causes lowering or hinging of the cover into an ideal position in front of the mouth, is contemplated, with the cover also providing noise protection and/or supporting additional noise-canceling microphone capabilities.

5 Ear bud and/or microphone and/or USB connections are accessed at one or both tube ends. In-line linear array noise-canceling microphone(s) are on or inside the length of the tube. Array noise-canceling microphone(s) are in a pattern around the end of the tube or extended from the tube so that when the tube is directed toward the other party, noise canceling is effective.

10 Rectangular tube cross-section form factors are contemplated, optionally in or in approximate ratio with the internal display. Two noise-canceling microphones optionally are provided, multi-language speech recognition and text-to-text translation software permitting use as a two-way mobile language translation device. Text-to-speech and speech-to-text capabilities also are

15 contemplated, as are other advanced translation capabilities that may become available in the future. Overall system dimension optionally depends on power-supply, hardware-size, or other requirements. The device is painted, coated, covered, textured and/or shaped to fit the particular needs of a user in a particular use environment. The device is designed to communicate, obtain and share

20 information, e.g. using Bluetooth technology. End plugs insertable into the tube case, or other device capabilities, optionally contain or include hardware and/or software for voice recognition, camera function, infrared sensors, audio sensors, mapping information, GPS, phone, physical/medical sensor monitoring, weapon

control/monitoring, other smart-system based applications, or other desired components and functionalities. The tube, parts of the tube, and/or end plugs/covers of the tube optionally are made of clear materials, permitting internal componentry to be seen.

5 Software and/or hardware selection or activation is provided by a separate application button, slide, or rotating mechanical device (e.g. a dial) either physically in the form of hardware or in the form of screen representations.

10 Embodiments of the invention are easily user-modifiable, and/or easily disassembled for repair/replacement. Friction fit, e.g. of the end caps, allows repair/replacement without tools. Memory-card replacement and optional device changes also may be made in the field by the user of the device or an appropriate service technician. Voice recognition optionally is a main interface to software and/or activation features of the device. The tube or other casing is mountable
15 on body or clothing, for example, for hands-free operation. Battery or other power-supply functionality optionally is located exposed on the outside of the tube, or partially on the outside of the tube.

The tube optionally provides access to connectors, for example USB connectors, for keyboarding input and/or for connection to other interface
20 devices, for example cameras, weapons, scanners, sensors, etc. The tube optionally is mounted to an arm or chest and is intermittently viewable with a head and/or arm motion in a hands-free manner. For example, the device is mounted vertically in front of the upper arm of a user, such that head tilt to one

side accesses viewer and/or microphone. The device optionally is mounted vertically on the front of the user's chest to one side, also for viewing without holding, or in a hands-free manner. The device also optionally is mounted on a necklace, the necklace integrating or supporting a noise-canceling microphone.

5 The tube optionally has a touch-pad surface and/or an eraser mouse or other mouse activation device adjoining or inserted into the tube. The mouse is located on the left side of the tube for a right-handed user, according to embodiments of the invention, at a position appropriately located for pointing-finger use when supported by the thumb and wrapped by the fingers.

10 The tube case optionally is vibrated, as a means to generate user-attention or audio sounds. Solid-state storage is inserted into a slot of the device, at one or both ends of the tube.

Additional reflective technology, as in e.g. a periscope supporting or providing optical communication to the display, facilitates mounting of the 15 device to a helmet or other body location, and permits the user to see the display in other than a direct-view position. End caps are used to facilitate water resistance during non-use. Additional low-heat transfer materials are inset and/or attached to an outer side of the tube case, e.g. for cooler hand-holding surface areas. Better heat release also is provided by maintaining the user's hand 20 off the case surface. For example, one or more strips of wood other material optionally are recessed into an outer aluminum tube case form factor. An additional memory storage device is attached to the outside of the device or inserted into an end of the tube, according to embodiments of the invention.

A group of small lenses forms a digital camera option for use in or with the invention. Relatively low-pixel capturing capacities feed multiple image capturing data to the device, using resident processing power to tile images to provide higher pixel detail in a mobile environment. A device provides photo

5 image slide shows and image enhancement application capabilities in a highly mobile environment. Digital camera lenses optionally are mounted on an expandable device, permitting the lenses to have a wider and/or variable pattern.

For example, lenses are mounted on one or more retracting/extending flexible stem(s). When retracted, the form is like a tight bud on a stem, and when

10 extended, the pattern has the appearance of a wide fountain. A fountain pattern of expanding and retracting microphones provides a grouping of more than one microphone, with spacing and/or patterning used in combination with algorithm-based software to enhance noise-canceling, for example. In retraction, this format permits easier-to-transport mobile device formats, and in extended mode

15 provides for improved patterns, for longer distances, for effective noise-canceling. Expanding/retracting form factors adjoin, or work in concert with, the multiple lenses or mini-lenses described.

An elastic enclosure captures and/or seals both ends and leaves openings for e.g. heat release, according to embodiments of the invention.

20 According to embodiments of the invention, the device is a two-way voice-based language translator. Parallel processing capacity operates a program to provide an audio form of translation validation. End caps have one or more

overlays to the tube ends to extend water protection. Optionally, the overlays are bound using plastic tie straps, bands, adhesive, or similar devices.

The battery or other power supply has multiple insert steps or stages to turn the system on or off, while still sealing the device, optionally a set point for 5 system sleep position. A cell phone optionally is built into the core as a part of the standard tube device. One or more antennas are exposed or integrated into a plug at the end or ends of the tube, to provide signal access. The device has enough sealed area or materials to cause buoyancy or flotation e.g. if inadvertently or intentionally dropped into water.

10 One or more processing or other component-mounting boards are made intermittently of flexible and rigid materials. The entire internal componentry optionally is provided on one board. One or more boards optionally are integrated into fold-over flexible end covers, optionally with a lens on one section, and optionally with one or more user sensors and/or activation devices

15 mounted on the end section. Flexible and/or rigid boards or board sections optionally incorporate one or more of the following: microphones, battery connectors, display and/or mounting means, antennas, application selection devices, mice, touch pads, reflection means for orienting the display viewed to a user, USB connectors, memory storage devices, cameras, cell-phone

20 components, speakers, infrared sensors, light sensors, heat sensors, motion detectors, air-quality sensors, and weaponry or weapon-system aiming or firing interfaces. An eraser mouse is provided on a narrow section of a board of the device, permitting it to be pressed down to fit into the tube assembly, and/or to

withstand impact. One or more boards optionally wrap around the power supply, and one or more of the boards and/or power supply are cushioned by foam materials. Board foam materials and battery optionally are wrapped together to fit into the tube and then are released, to expand and fill the tube.

5 Recharging optionally occurs in a body-wearable holster or holding device. Mounting devices optionally are fitted to the arm and free hands of a user, while viewing, and/or speaking to, the device. The device optionally is mounted on a necklace, for example a stiff necklace that permits the device to be positioned to eye level without holding or other intervention or maintenance with
10 the hands of the user.

A personal computing and/or communication device, and/or associated electronic means or systems, are housed between tube-shaped extrusions made of heat-transferring material and plugged/capped at each end, according to embodiments of the invention.

15

Conclusion

Personal-computing processing power currently available in desktop and portable formats is still limiting mobile user applications, due to awkward form factors and intermittent interface software limitations, for example. Personal
20 computer processing power has a growing number of interface and support features for mobile hardware attachments. Mobile personal computer processing power requires less heat-sink heat removal due to new low-power/high processing power chips, for example the Centrino brand chip.

A tube-shaped electronic device according to embodiments of the invention provides excellent continuous material for heat sink purposes, provides an excellent format for holding the shape of a low-powered micro-display viewer system, provides an excellent format for inserting and holding battery and

5 hardware items from one end, provides an ideal shape for holding in a human hand, provides an excellent shape for protecting a lit display, e.g. an internal lit display, from ambient light, provides general seamlessness for system durability and water/dust proofing, once the ends are capped, and provides low-cost mass-produced COTS packaging material. Tube extrusions easily are made in

10 different thicknesses, which optionally are selected according to user durability needs and heat-dissipation needs. Tube-shaped electronic devices according to embodiments of the invention provide an excellent shape for plugging the device into a docking station or other station for e.g. providing larger display capability, charging, and interfacing other hardware devices, including weapons and large-

15 screen projectors, for example. A tube-shaped electronic device also provides an ideal shape to provide protection from unwanted exposure to light, either ambient light or light generated by the device itself, and also provides an ideal shape for providing data privacy.

Accordingly, a tube-shaped personal computing device/communicator

20 device according to embodiments of the invention is uniquely qualified to be a singular design of value, providing unequaled assets to military, commercial, and consumer users. Additional modifications and embodiments according to the invention will be apparent from this description.